BIOLOGICAL AND TAXONOMIC NOTES ON THE WASPS OF LOST RIVER STATE PARK, WEST VIRGINIA, WITH ADDITIONS TO THE FAUNAL LIST

(HYMENOPTERA, ACULEATA)

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The wasp fauna of Lost River State Park, Hardy County, West Virginia, has been discussed in two previous papers. The first paper (Krombein, Proc. Ent. Soc. Wash. 54: 175-184, 1952) presented an annotated list of 78 species collected June 18-25 and July 18, 1951. The second paper (Krombein, Bull. Brooklyn Ent. Soc. 49: 1-7, 1954) recorded 79 species collected June 29-July 5, 1953, of which 24 species had not been obtained in 1951.

In 1955 we were again able to spend part of our family vacation in the Park, from July 4 to 11. The collections made during this period included 81 species of wasps, of which 26 are new to the Lost River list, thus bringing the total known from the Park to 128 species. Collection data are presented below for the 26 species new to the list, and the opportunity is also taken to add a few biological notes, and descriptions of *Epyris deficiens*, n. sp., *Chalcogonatopus harpax*, n. sp., and of the putative male of *Ammoplanus unami* Pate.

ADDITIONS TO THE WASP FAUNA

Family **BETHYLIDAE**

Epyris deficiens, n. sp. 1 ♀; July 10; crawling on damp decaying tree stump in dense shade.

Family **DRYINIDAE**

Chalcogonatopus harpax, n. sp. 1 ♀; July 9; crawling on fence rail beneath oak.

Deinodryinus atriceps (Brues). 1 ♀; July 10; crawling on foliage of *Vaccinium* in sun along edge of trail.

Deinodryinus grandis (Brues). 1 ♀; July 7; crawling on foliage of *Vaccinium* in sun along edge of trail.

Family **TIPHIIDAE**

Tiphia affinis Malloch. 1 ♀; July 7; along trail on foliage.

Tiphia jaynesi Allen. 1 ♂; July 9; along trail on foliage.

Tiphia subcarinata Malloch. 1 ♂; July 10; along trail on foliage.

Family **MUTILLIDAE**

Timulla (Timulla) dubitatiformis Mickel. 1 ♀; July 6, crawling on ground along edge of trail in sun.

Family **VESPIDAE**

Eumenes fraternus Say. 1 ♀; July 10; flying along edge of trail; somewhat worn.

Ancistrocerus unifasciatus (Saussure). 1 ♀; July 7; hovering before log in cabin wall; unworn.

Family **POMPILIDAE**

Dipogon (Deuteragenia) papago anomalus Dreisbach. 1 ♀; July 10; on vegetation along trail; somewhat worn.

Ageniella (Ageniella) mintaka Brimley. 1 ♂; July 4; along trail in shade; fresh. Recorded as **Ageniella (Ageniella)** sp. in 1954.

Minagenia osoria (Banks). 1 ♂; July 10; along trail; fresh.

Evagetes hyacinthinus (Cresson). 1 ♀; July 10; along trail; worn.

Evagetes parvus (Cresson). 2 ♀♀; July 7 (worn) and 10 (fresh); along trail.

Agenioideus (Gymnochares) birkmanni (Banks). 1 ♀; July 10; around cabin; fresh.

Pompilus (Ammosphex) imbecillus imbecillus (Banks). 3 ♂♂; July 7, 8 and 9; along trail; fresh.

Pompilus (Anoplochares) similaris (Banks). 2 ♀♀; July 9 (worn) and 10 (fresh); along trail.

Family **SPHECIDAE**

Solierella nigrans Krombein. 1 ♂; July 4; along trail on fallen twig in sun; fresh.

Trypoxylon (Trypoxylon) adelphiae Sandhouse. 1 ♀; July 5; in open woods; fresh.

Trypoxylon (Trypoxylon) backi Sandhouse. 1 ♀; July 10; hovering before log in cabin wall; somewhat worn.

Trypoxylon (Trypargilum) clavatum Say. 2 ♀♀; July 10; along trail; fresh.

Mimesa (Mimumesa) johnsoni Viereck. 1 ♀; July 4; hovering in front of nest entrance in log in cabin wall; unworn.

Pemphredon (Pemphredon) nearcticus Kohl. 1 ♀; July 11; in woods; fresh.

Pemphredon (Cemonus) bipartior Fox. 1 ♀; July 10; along trail; fresh.

Ammoplanus (Ammoplanus) unami Pate. 1 ♂; July 10; hovering in front of logs in cabin wall in sun; fresh.

Chlorion (Isodontia) harrisi Fernald. 3 ♀♀, 6 ♂♂; July 7-10; along trail; somewhat worn.

Biological Notes

Family **TIPHIIDAE**

Myrmosa (Myrmosa) unicolor Say

A male (71055 B) was captured at 11 a.m. on July 10 while flying in copula with a female which was hanging from the tip of his abdomen. The male was a freshly emerged specimen 8.8 mm. long, and the wingless female was a freshly emerged specimen 4.1 mm. long. The male had a firm hold on the female and did not relax his grasp even after the pair was placed in a cyanide jar. However, the female had made an effort to free herself because the long axis of her body is at right angles to the long axis of the male with her venter upward. The male hypopygium is still in contact with that of the female, so it seems probable that the normal position during mating is for the female to be held beneath the male, venter to venter. Dr. H. K. Townes writes me that he has seen this species in copula several times, the male crawling, flying, and crawling again after flying with a female attached tail to tail and, as he recalls, venter to venter. He notes that the male abdomen is held somewhat elevated when the female is attached. His mating pairs separated quickly in a net.

Family **VESPIDAE**

Symmorphus canadensis (Saussure)

Females were nesting in moderate abundance in deserted beetle borings in logs in the cabin walls. One female (7855 A) was observed on July 8th bringing in paralyzed, leaf-mining chrysomelid larvae (*Chalepus*) to her nest in full shade on the cabin porch. She brought in one larva at 9:25 a.m., and successive larvae at 9:40 and 9:50. These observations on the provisioning cycle were then terminated. The wasp remained in her nest for a couple of minutes each time that she brought in a beetle larva. The wasp was captured on July 10th as she was constructing a clay plug to seal the boring entrance.

Family **POMPILIDAE**

Psorthaspis mariae (Cresson)

A newly emerged female was noted crawling in the sun on a gravelly slope along the edge of a trail at 3 p.m. on July 10th. A worn male was trailing excitedly a few inches behind her, and both were captured with one sweep of the net. This pairing confirms the tentative association of sexes in this species suggested by J. C. Bradley (Trans. American Ent. Soc. 70: 75, 1944), though the subgenital plate in the present male specimen shows some variation in being shallowly emarginate at the tip.

Family **SPHECIDAE**

Spilomena pusilla (Say)

An unworn female (71055 A), 2.6 mm. long, was captured at 4 p.m. on July 10th while she was hovering in the sun in front of her nest entrance in a log in the cabin wall 2.5 meters above the ground. She was carrying an adult winged thrips 1.25 mm. long. The prey record is rather unusual in that the wasp had captured an adult thrips. I have taken *pusilla* with its prey frequently in Arlington, Virginia, from May 28th to September 26th. In every case the prey was a larval thrips, 0.64-1.01 mm. long.

Trypoxylon (Trypargilum) striatum Provancher

An unworn female 16 mm. long nested in a wooden trap nest (E 14) having a boring 150 mm. long and 6.4 mm. in diameter. This trap had been placed horizontally 1.2 meters above the ground on a pile of logs cut for the fireplace. The entrance to the boring faced west and was shaded for most of the day. The trap had been set out on July 4th and an occupant was first noticed in it on July 8th. It was taken up the evening of July 10th at which time it contained the female wasp. Upon being split lengthwise that evening the nest was found to consist of three cells fully stocked with small paralyzed spiders and a single spider at the inner end of what would have become the fourth cell. There was a clay plug 3 mm. thick at the inner end of the boring. The cells, measured from the inner end of the boring, were 25, 28 and 23 mm. long The clay partitions closing each cell were about 2 mm. thick in the center, had the shape of a diverging meniscus, and were so oriented that the rather irregular convex surface was toward the inner end of the boring and the smooth concave surface toward the outer end.

The first (innermost) cell contained three spiders belonging to two species, and the wasp egg was laid on the abdominal dorsum of the last spider placed in the cell. Cell 2 contained six smaller spiders belonging to three species and the egg was laid on the side of the abdomen of the last spider brought in. The third cell contained 11 spiders, 3.8-4.6 mm. long, belonging to three species and the egg was laid on the abdominal dorsum of the fifth spider brought in. The wasp egg in cell 3 shriveled after several days, so the spiders were placed in alcohol and were identified as follows by B. J. Kaston: two females and one male of the araneid, *Neoscona minima* Camb. and what appear to be five juveniles of the same species; a juvenile araneid of another species; and a female anyphaenid, *Anyphaena pectorosa* Koch.

The wasp eggs in cells 1 and 2 had not hatched by the evening of July 11, but had done so by the morning of the 12th. These larvae had completely eaten all spiders stored in their cells by July 15th and began to spin cocoons.

The cocoons are made of a thin layer of tightly woven pale silk impregnated with a fluid, possibly of meconial origin, which dries to form a varnished, brittle, dark brown substance. Fragments of clay from the closing plug are incorporated in the outer end of the cocoon. The more solid part of the meconium is voided at the inner end of the cocoon and dries to form a solid black ring several millimeters wide near the end of the cocoon wall or a solid pellet at the inner end of the cocoon. There is a small black nipple on the inner surface of the outer end of the cocoon. The cocoon is circular in cross section with a rounded inner end and parallel sides which flare outward just before the outer end which is less strongly convex than the inner end. The cocoons in cells 1 and 2 were 15.5 and 13.5 mm. long and had been completed by July 18th. The cocoon in cell 2 was oriented with the head end toward the inner end of the boring, but that in cell 1 was properly oriented with the head end outward. Apparently there is only one generation a year, for the inhabitants of cells 1 and 2 were still prepupae at the end of fall.

Taxonomic Notes

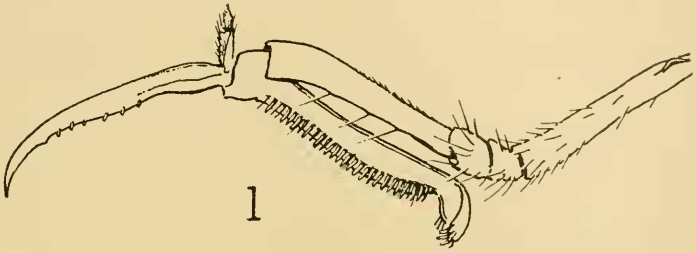
Family **BETHYLIDAE**

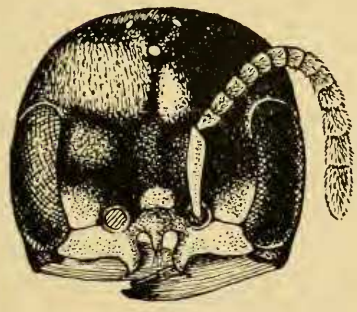
Epyris deficiens, new species
(Figure 3)

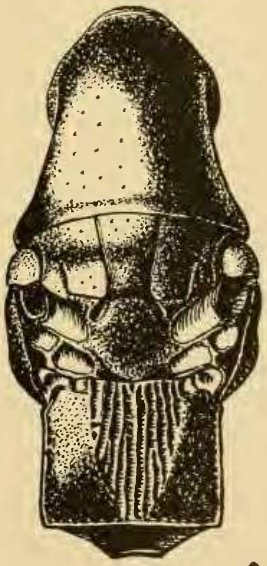
This is the first species of *Epyris* known from North America which is entirely wingless in the female. Although *E. texanus* (Ashmead) was described as being wingless, the type actually is brachypterous and the narrow wing pads extend backward to the anterior third of the propodeum. The present species may be distinguished from the other known Nearctic species by the following combination of characters: relative proportions of head; femora infuscated; scutellar pits elliptical; central U-shaped area of propodeal dorsum with strong regular rugae, lacking interspersed transverse or irregular rugulae; lateral areas of propodeal dorsum shining and very delicately and minutely alutaceous.

The unique type was walking on the surface of a damp, decaying tree stump in dense shade. It is presumed that the species may be parasitic on coleopterous larvae boring in decaying wood in such a habitat.

Type. ♀ ; Lost River State Park, Hardy Co., West Virginia; July 10, 1955 (K. V. Krombein) [donated to U. S. National Museum,Type No. 63039].







Drawings by A. D. Cushman.

Fig. 1, *Chalcogonatopus harpax*, fore tarsus of female, anterior view, X52; fig. 2, *Ammoplanus* (*Ammoplanus*) *unami*, frontal view of male head, X52; fig. 2a, the same, modified abdominal sterna, X105; fig. 3, *Epyris deficiens*, thoracic dorsum of female, X39.

Female.—Length about 5 mm. (head and thorax 2.4 mm., abdomen lost after some preliminary notes were made). Black including abdomen, the following reddish: mandible except narrowly at base, antenna except flagellum above which is brown, tegula, legs except femora which are brown. Head above, thorax above and mesopleuron with rather short, sparse, suberect grayish hairs.

Head broadly rounded posterolaterally, the greatest width 0.9 times the length; ocelli in a small, almost equilateral triangle, the posterior pair about twice their diameter from occipital carina; mandible at apex with a strong acute tooth below and a broad blunt lobe above, carina along lower edge of mandible present except on apical fifth; front with a very faint impressed line along midline from between antennae to about one-fourth the distance to anterior ocellus; front and vertex moderately shining, finely and distinctly alutaceous, with scattered, moderately large punctures separated from each other by from 1.5 to 3 times the diameter of a puncture; eyes oval, almost touching anterior mandibular condyle, the length 1.4 times the width, with scattered erect hairs a bit shorter than those on front; occipital carina complete beneath, separated from hypostomal carina on midline by half the distance between the posterior mandibular condyles.

Thoracic dorsum as figured (fig. 3); pronotum arched, somewhat foreshortened in fig. 3, the median length including collar 1.16 times the width at posterolateral lobes, sculptured similarly to front except punctures more remote and surface a little duller, the narrow apical margin smooth and polished; sculpture of scutum and scutellum similar to that of pronotum but surface more shining; tegulae fully developed; mesopleuron moderately shining, finely and distinctly alutaceous, impunctate; metapleuron shining; median U-shaped area on propodeal dorsum with about seven complete, rather straight rugae, the dorsal areas laterad of U-shaped area shining and very delicately and minutely alutaceous; lateral and posterior margins of propodeal dorsum with a strong carina; posterior surface of propodeum with a moderately strong keel along midline extending downward almost to abdominal insertion, the areas laterad of keel shining and alutaceous, the area below keel with a few, fine transverse striae; sculpture of lateral surface of propodeum as on mesopleuron.

Legs stout; mid femur about 1.85 times as long as greatest width; mid tibia with six weak spines in addition to pubescence; tarsal claws each with a tiny erect tooth in middle.

Abdomen shining, sparsely pubescent; apices of third to fifth sternites hyaline, narrowly notched on each side of midline.

Male. Unknown.

Family **DRYINIDAE**

Chalcogonatopus harpax, new species
(Figure 1)

The present species runs to *C. echo* Perkins from Nogales, Arizona, in that author's key (Div. Ent., Hawaiian Sugar Planters' Assn., Bull. 4: 16, 1907). It differs from *echo* in having the entire thorax and first abdominal segment reddish or brown, basal three segments of antenna not yellow, posterior slope of propodeum shining and with numerous transverse wrinkles, and fifth tarsal segment beneath with

two rows of lamellate denticles, one row longer and composed of numerous close-set denticles, the other row shorter and composed of about six well-separated denticles. Of the described eastern species, *harpax* seems closest to *C. flavifrons* (Ashmead), n. comb. (*Gonatopus flavifrons* Ashmead, Bull. U. S. Nat. Mus. 45: 84, pl. 5, fig. 4, 1893.), but the thorax does not have a dull, alutaceous surface, the face lacks yellow, and the pronotum posterolaterally has several close, oblique wrinkles.

Type. ♀ ; Lost River State Park, Hardy Co., West Virginia; July 9, 1955 (K. V. Krombein; crawling on fence rail beneath oak [donated to U. S. National Museum, Type No. 63040].

Female.—Length 3.7 mm. Head, thorax, first abdominal segment and legs reddish brown, the head lighter beneath and infuscated above, pronotum posterolaterally and sides of propodeum darker, and hind tibia narrowly infuscated at apex; rest of abdomen black; clypeus and declivous part of front light straminеous; scape beneath creamy. Face with some dense slivery decumbent hairs along inner eye margins below; thorax with scattered, inconspicuous, erect light brown hair.

Head 1.5 times as broad as long, moderately concave above, the surface above glossy except minutely roughened areas narrowly along eyes and posteriorly in a transverse, arcuate band behind ocelli; antenna relatively slender at base, becoming somewhat broadened toward apex, comparative lengths of segments as 30:18:55:32:25:22:20:18:18:22.

Pronotum divided dorsally by a deep transverse groove into an anterior transverse area which is 0.3 times as long as narrower, posterior section; pronotum shining, impunctate and glabrous except posterolaterally where there is a patch of dense minute punctures just above the area of close oblique wrinkles on the side; mesonotal constriction twice as long as its median width, not carinate along midline but with a lateral sulcus above on anterior two-thirds; propodeum above smooth, posteriorly with moderately close, transverse wrinkles, on sides with these wrinkles oblique.

Fore trochanter with narrow basal stalk much shorter than enlarged apical part; fore tarsus as figured (fig. 1), the first and fourth segments subequal in length, the fifth beneath with a longer complete row of lamellate denticles reaching almost to articular cavity and a shorter row of about six separated denticles, claw with a few short, separated denticles beneath and a small blunt tooth three-fourths of distance to apex.

Abdomen shining, except bases of second and third tergites with a narrow transverse area composed of close, short aciculations.

Male.—Unknown.

Family **SPHECIDAE**

Ammoplanus (Ammoplanus) unami Pate

(Figures 2, 2a)

Ammoplanus ceanothae Viereck, 1904, Psyche 11: 72 (♀♀ in part, not ♂ lectotype designated by Pate).

Ammoplanus (*Ammoplanus*) *unami* Pate, 1937, Trans. Amer. Ent. Soc. 63: 101, figs. 2, 14 (♀ ; Lehigh Gap, Northampton Co., Pa.; Academy of Natural

Sciences, Philadelphia); Pate, 1942, Bull. So. Calif. Acad. Sci. 41: 154, fig. 9 (♀); Krombein, 1951, U. S. Dept. Agr., Agr. Monogr. 2: 969.

The male described below agrees in most details of the sculpture with the original description of the female of *unami,* and it seems quite probable that this association of sexes is correct. Both sexes were taken in the Appalachian Mountain system about 200 air miles apart. The conformation of the male clypeus (fig. 2) and of the fifth and sixth abdominal sterna (fig. 2a) distinguish it at once from males of all other North American forms. The type series of *unami* cannot be found in the Academy of Natural Sciences at Philadelphia, so it has not been possible to make a direct comparison.

Plesiotype. ♂ ; Lost River State Park, Hardy Co., West Virginia; July 10, 1955 (K. V. Krombein; hovering in front of logs in cabin wall in sun).

Male.—Length 2.3 mm. Black: the following ivory—mandible except apex, clypeus except median lobe, small semicircular spot on front above median lobe of clypeus, larger anterolateral subtriangular spot on front, scape, pedicel and first four flagellar segments beneath, apices narrowly beneath of remaining flagellar segments except the last; the following fulvous—apex of mandible, median lobe of clypeus, fore trochanter beneath, fore tibia externally and all tarsi. Wings as in female. Vestiture as in female except on modified sterna.

Head (fig. 2) shining, with greatest width subequal to length, broadly rounded posterolaterally; clypeus in middle quadrately excised almost to antennal sockets, the excision in middle with a slender linguiform lobe, lateral angles of excision produced into a rather stout, curved tooth; front without a median keel running upward from clypeus, in profile obtusely angled near top of eyes, the lower part more strongly alutaceous, the upper part and vertex delicately alutaceous and with a few scattered minute punctures; inner eye margins somewhat divergent above, the distance between eyes at frontal angulation 1.2 times the distance between them at base of clypeus; flagellar segments flat beneath.

Pronotum narrow, transverse, rounded and gradually declivous to neck, situated below level of mesonotum and about half as wide, the tubercle almost touching tegula, the surface finely alutaceous and moderately shining; mesonotum shining in middle, less so on sides, the middle smooth except for a few minute, dispersed punctures, the rest of mesonotum less shining and finely alutaceous, longitudinally so on sides, transversely so on apical part, notauli lacking; scutellum and postscutellum shining, sculptured much as is middle of mesonotum; mesopleuron shining, longitudinally semi-aciculate; metapleuron with aciculations sloping downward and posteriorly; propodeum less shining than mesopleuron, the dorsal surface with a fine median keel laterad of which are weak, inconspicuous, fine, irregular reticulations arranged more or less in oblique lines, the lateral surface with close, oblique aciculations, and posterior surface smooth except for a median sulcus.

Abdomen fusiform, shining, not constricted between segments; first two terga glabrous, the remaining terga and first three sterna with scattered, sparse, decumbent aeneous setae; fourth sternum with these setae more closely grouped apically; modified sterna (fig. 2a) as follows: fifth sternum with apex deeply

and broadly emarginate, the lateral lobes clothed with dense, long, light brown decumbent hair, the apices of the lobes visible from above as small, rounded projections adjacent to base of sixth tergum; sixth sternum strongly elevated along midline on apical half, a triangular area at base and a narrow strip along median ridge bare, the declivous areas laterad of median apical ridge clothed with very dense, short, erect silvery hair; seventh sternum completely retracted, very strongly raised along midline, apparently clothed as is the sixth; eighth sternum with exserted apical part very narrow, elongate linguiform, the sides minutely serrulate, apex bluntly rounded.

THREE NEW NORTH AMERICAN SPECIES OF TREE-HOLE CULICOIDES
(DIPTERA, HELEIDAE)

By WILLIS W. WIRTH[1] and ROBERT H. JONES[2]

Increased attention to the taxonomy and biology of biting midges of the genus *Culicoides* has resulted in the rapid addition of many new species to the already large list of North American members of this genus. The recognition of these additional species is due in part to the utilization of more minute structural characters, and in part to rearing work which enables the procurement of species not ordinarily attracted to light traps or not commonly collected in series long enough to give the taxonomist adequate material for comparison and placement.

This paper increases the number of known Nearctic tree-hole breeders to ten, the previously described species being *arboricola* Root and Hoffman, *borinqueni* Fox, *flukei* Jones, *guttipennis* (Coquillett), *nanus* Root and Hoffman, *ousairani* Khalaf, and *villosipennis* Root and Hoffman. A few other described species probably breed in tree holes, but their biology is still unknown.

Since two of the species described here as new, *snowi* and *cavaticus*, fall into the *unicolor* complex, it seems advisable to present keys to the species involved. The two previously known species in this complex, *unicolor* (Coquillett) and *piliferus* Root and Hoffman, are not tree-hole species.

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